

Modified Collins Cryocooler for Cryo-Propellant Thermal Management, Phase II

Completed Technology Project (2009 - 2012)



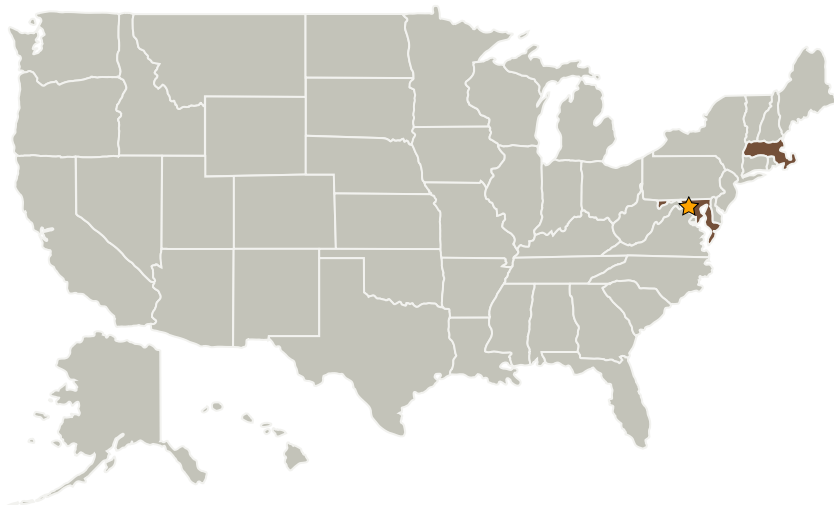
Project Introduction

Future lunar and planetary explorations will require the storage of cryogenic propellants, particularly liquid oxygen (LOX) and liquid hydrogen (LH2), in low earth orbit (LEO) for periods of time ranging from days to months, and possibly longer. LEO is a relatively warm thermal environment and without careful thermal management, significant quantities of stored liquid cryogenics can be lost due to boil-off.

Anticipated Benefits

In addition to application for ZBO of stored cryogenic propellants, sub-cooling to densify LOX and LH2 has the potential to reduce the gross launch weight of a vehicle by up to 20%. Additional applications exist to cool instruments to temperatures as low as 4K. Currently this is accomplished primarily by launching a dewar of liquid helium with the instrument payload. The modified Colling cycle cryocooler technology is particularly well suited to cooling applications in a temperature range from 4K to about 60K. At temperatures above 60K the efficiency advantages of the modified Collins cycle become less significant with respect to that of Stirling and pulse-tube cryocoolers. However, significant technology applications exist in the sub-60K temperature range. These include cooling HTS-transmission cables (60K and lower), the NASA ZBO application (20K), cooling space optical systems (10K), and terrestrial applications such as cooling MRI & NMR magnets (4K) and cooling LTS superconductors and devices (4K).

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland
Advanced Mechanical Technology, Inc.	Supporting Organization	Industry Small Disadvantaged Business (SDB)	Watertown, Massachusetts

Primary U.S. Work Locations

Maryland	Massachusetts
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Project Transitions

 **June 2009:** Project Start

 **June 2012:** Closed out

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Project Manager:

Gary C Jahns

Principal Investigator:

Charles Hannon

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Technology Maturity (TRL)

Start: **3**
Current: **3**
Estimated End: **4**



Technology Areas

Primary:

- TX14 Thermal Management Systems
 - └ TX14.1 Cryogenic Systems
 - └ TX14.1.1 In-space Propellant Storage & Utilization